In Vivo Length Changes of Scapholunate Interosseous Ligament at Wrist Full Extension and Forearm Rotation

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The SLIL has a critical role in maintaining the proper kinematic relationship between the scaphoid and the lunate. When one falls on an outstretched hand, wrists are usually at positions of extension with maximal pronation or supination. We hypothesize that the length of the SLIL changes significantly at wrist full extension and during forearm rotation. Therefore, we examine changes in the length of the SLIL during wrist full extension and forearm rotation. We also investigate the changes in the length of SLIL at full extension with maximal pronation and full extension with maximal supination in vivo.

## OBJECTIVES

The SLIL has a critical role in maintaining the proper kinematic relationship between the scaphoid and the lunate. When one falls on an outstretched hand, wrists are usually at positions of extension with maximal pronation or supination. We hypothesize that the length of the SLIL changes significantly at wrist full extension and during forearm rotation. Therefore, we examine changes in the length of the SLIL during wrist full extension and forearm rotation. We also investigate the changes in the length of SLIL at full extension with maximal pronation and full extension with maximal supination in vivo.

## METHODS

This study involved three groups, full extension group, rotation group, and extension with maximal rotation group. Each group had six volunteers. They were evaluated with history, examination, and biplanar radio graphs to exclude upper limb pathology. All of the subjects were right handed.

1. **Collection of CT images at Different positions:** The hand of each volunteer was placed in a custom-designed non-metallic supporting frame before undergoing CT scanning. A high-speed, 16-slice spiral computed tomography scanner was used.

2. **3-dimensional Reconstruction:** We used data from the CT scans to reconstruct 3-D images and measure with analytic software (Mimics 10.0; Materialise, Leuven, Belgium). We defined the three regions of the SLIL according to their known bone insertions and marked the origin and insertion of these ligaments on the surfaces of the bone reconstructions. Each of the three different regions of the SLIL was further divided into three portions for measurement (Fig. 1). At each wrist position, the shortest paths of the SLIL were modeled and measured directly.

## RESULTS

1. **Changes in the length of SLIL at wrist full extension:** From the neutral position to full extension, the length of the v-SLIL and volar, middle portions of the p-SLIL increased significantly. Furthermore, from full extension to full extension with $10^\circ$ radial deviation, the lengths further increased. No significant differences were noted in the lengths of the dorsal portion of the p-SLIL or any portion of the d-SLIL during wrist full extension (Fig. 2). Scapholunate injuries are the most frequent intercarpal ligament injuries in the wrist. During wrist full extension and full extension with radial deviation, or with forearm maximal rotation, all portions of the volar SLIL and most of the proximal SLIL were elongated relative to neutral length. At forearm maximal pronation, all portions of the volar SLIL and most of the proximal SLIL were elongated relative to the neutral length, and at forearm maximal pronation/supination, the distal portion of dorsal SLIL was shortened. Based on our findings, it is clear that wrist full extension placed great strain on the volar SLIL and proximal SLIL and may result in these regions tearing first.

## DISCUSSION AND CONCLUSIONS

Scapholunate injuries are the most frequent intercarpal ligament injuries in the wrist. During wrist full extension and full extension with radial deviation, or with forearm maximal rotation, all portions of the volar SLIL and most of the proximal SLIL were elongated relative to neutral length. At forearm maximal pronation, all portions of the volar SLIL and most of the proximal SLIL were elongated relative to the neutral length, and at forearm maximal pronation/supination, the distal portion of dorsal SLIL was shortened. Based on our findings, it is clear that wrist full extension placed great strain on the volar SLIL and proximal SLIL and may result in these regions tearing first.